CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

Application of RJSeal™
Yangtze River Bridge, JiuJiang, JiangXi, Peoples Republic of China

September 2004

TS^2 Consulting Inc.
Lamma, Hong Kong

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TABLE OF CONTENTS

FIGURES

TABLES

CROWN CAPITAL ENTERPRISE LIMITED

Application of RJSeal
Yangtze River Bridge, JiuJiang, JiangXi,
Peoples Republic of China

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APPENDICES

No.	Description
A	RJSeal™ Descriptive Literature
B	Technical Specifications – Desco D200 Sprayer
C	Size Analysis – Kunming Copper Slag

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1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Yangtze River Bridge Company of JiuJiang, China in September 2004. This arrangement calls for the application of RJSeal™, a sealer/rejuvenator for asphalt pavement on the Yangtze River Bridge, near JuiJiang, Jiangxi Province.

JiangXi Province lies south of the Yangtze River (Chiang Jiang), at the juncture with PanTiang Lake. Hubei, GuangDong, Fujian, and Anhui and Zhejiang Provinces border JiangXi Province. JiangXi has seen a major growth in the highway system, due to a government drive to build national highways linking JiangXi with major cities in the adjoining provinces. JiuJiang lays approximately 140 kilometres north of NanChang, the capital city of JiangXi, and lies on the south bank of the Chiang Jiang River. The present population of JiuJiang is estimated at approximately 0.8 million. See figure 1.0 for a map showing the location of JiangXi. The majority of the area lies at 50 to 100 metres in elevation, on the extensive plain that borders the East China Sea. The regions' latitude (26 to 29 degrees north) means that there are four seasons, with temperatures ranging from 42 Celsius in the long, hot summer to minus 5 Celsius in the short winter. NanChang is known as one of the "Four Ovens" of China, due to the high temperatures in the summertime. There is a rainy season, which stretches from June thru in to September.

In the immediate JiuJiang area, a significant consolidated sedimentary sequence predominates and there are a number of outcrop exposures available. The predominant rock type is a weekly-cemented pink sandstone, which can be readily quarried with rudimentary tools and is used primarily in the construction of buildings and retaining walls. This same material forms the predominant construction stone for the Yangtze River Bridge. The asphalt in the area is manufactured from crushed and screened sandstone hauled from quarries in close proximity to the Yangtze River Bridge, as well as washed sand from the various rivers. The bitumen binder for the asphalt is sourced from various locations.

2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with Yangtze River Bridge Company of JiuJiang is to demonstrate RJSeal™ at the location selected by the Yangtze River Bridge Company. The Application will subsequently allow analysis of the performance of RJSeal™ on the aged asphalt surfaces. An application was undertaken on Yangtze River Bridge, immediately east of the city of JiuJiang on September 2 thru 4, 2004. The portion of the Bridge that was treated was composed of asphalt pavement of 1990's vintage. No details are known about the underlying material, but suspect it is a concrete deck. The surface of the asphalt is quite worn with rutting and a substantial number of cracks and concern had been expressed about water percolating through the porous pavement and corroding the concrete deck. Furthermore, this asphalt pavement is very old and it was apparent that the bitumen was highly oxidized and the ductility was less than optimal and keen interest was expressed in having the bitumen ductility improved

3.0 RJSEAL™

RJSeal™ is a proprietary product that is supplied by Crown Capital Enterprise Limited of Wanchai, Hong Kong. RJSeal™ has been proven in numerous applications in North and South America to rejuvenate asphalt pavement at various stages of its life and economically extend the life of the pavement. RJSeal™ is a three component, asphalt sealer rejuvenator that is comprised of Coal Tar, Coal Tar Oils and Petroleum Solvents.

3.1 PRIOR EXPERIENCE

Refer to Appendix A for a copy of the brochure this outlines the experience with RJSeal™ at various locations in North America and South America. Further information is available from Crown Capital Enterprise Limited. RJSeal™ has been used at numerous airports in North and South America, as well as highways in Alberta, Canada; Cearo State, Brazil and North Dakota and Texas, as well as other locations in the U.S.A. Since 2000, RJSeal™ has been demonstrated successfully at over fourty (40) locations in China and twenty (20) commercial-scale applications have taken place at various locations, including Shanghai, QinHuangDao, DaQing and Kunming.

4.0 RJSEAL™ APPLICATION

Since Jiangxi Province is located in a semi-tropical climate (Latitude: 26 to 29 degrees North) at a low altitude (50 to 100 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 45 Celsius in summer and minus 5 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

JiangXi has a significant concentration of highways in China, with some 18,000 kms of National and Provincial Highways. The Yangtze River Bridge Maintenance Company is responsible for maintenance of the bridge, that stretches 1,811 metres across the Chang Jiang River, joining JiangXi Province on the south shore to Hubei Province on the north shore. The owner of the Bridge is a tri-party company, collectively owned by JiangXi Province, Hubei Province and AnHui Province

In view of the aforementioned problems with this bridge, the Yangtze River Bridge Company is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, the Yangtze River Bridge Company has agreed to try RJSeal™ on the Yangtze River Bridge, just east of the city of JiuJiang. See Figure 4.0, showing the location of this Bridge with respect to JiuJiang and NanChang.

The bridge is located at the following geographic location:

Table 4.1	**Geographic Location of Bridge**		
Position	**System**	**Northing**	**Easting**
North End	Geographic (deg, min)	29^0 45.508'	116^0 00.532'
	Universal Transverse Mercator Grid (50R) (metres)	3292445	0404175
South End	Geographic (deg, min)	29^0 44.638'	116^0 01.029'
	Universal Transverse Mercator Grid (50R) (metres)	3290831	0404962

The Application Section on the bridge encompassed the portion carried on a steel truss deck, some 1,811 metres long, on the Yangtze River Bridge is located approximately 0.9 Kilometres east of the City of JiuJiang. See figure 4.0, which follows, for a location of the general locale. The location of bridge is graphically shown in figure 4.1, which follows.

On September 2 a short test strip was sprayed using the Desco D200 Sprayer at the south end of the bridge. Subsequent inspection of this test strip on September 2, showed that the application rate of 4.5 m^2/kg was appropriate for the asphalt pavement at this location and could be used as a guide for other locations with similar physical characteristics. See Figure 4.2 showing the test strip

Figure 4.1 General Overview of
Yangtze River Bridge at JiuJiang

Figure 4.2 Test Strip of RJSeal using
Desco D200 Sprayer

Work commenced at 1:00 pm on September 2, on a warm, windy overcast day, where the mid-day temperature reached 28 Celsius. Several days of heavy rain had preceded the application on September 2. Although September 1 had a slight drizzle in the morning but was clear for the afternoon.

The first section treated was, 330 metres long, on the south end of this two lane bridge. This portion is located on a straight section and commences on the steel truss portion of the bridge over the Chiang Jiang (Yangtze) River. There is a slight camber to the road, which causes water to run off toward the shoulder, rather than puddle on the road. The asphalt surface on the section treated, was reputedly 1990's vintage. No significant oil spills were observed, just the occasional drop of transmission oil, crankcase oil or hydraulic fluid. The asphalt pavement surface was appreciably worn with rutting evident in places. There were longitudinal cracks and lateral cracks with some portions showing some alligator style cracks. Some potholes with alligator cracks had been milled down and patched with new asphalt just one day prior to the application

On September 2, the Desco D200 Sprayer was used to spray RJSeal on the bridge deck. The width of the two vehicle lanes are 3.6 metres between the painted centre dividing line and the shoulder marker line. A bicycle path, nominally 2.5 metres, occurs on the outside of the vehicle lane. RJSeal™ was applied, using a Desco D200 Sprayer, to ensure uniformity in the application. The work was completed in two stages, first on the east side (northbound lane) and once that was dry then the west side (southbound lane). Work on this initial test strip finished at 6:00 pm.

Ambient temperatures at the time of the application were in the 25 to 28 degree Celsius range, with humidity in the 75% range. The site was visited on September 3 around 8:20 am and a difference was readily perceived between the RJSeal™ treated section and the adjoining untreated lanes. This was one day after the application of RJSeal™ and at this location the newly treated surface was evident, as the black resilient surface layer, which was now approximately 1millimetre thick, did not allow water to puddle on the surface, as it immediately ran off. . No carryover of the RJSeal™ was observed from vehicle tires at the north end of the Application strip, so it can be presumed that the surface was dry

The second portion treated, some 550 metres long, is located immediately north of the first section on this two lane Bridge. The treated section is located in the portion of the bridge where the superstructure has three large arches with a 11 metre wide span between the arches and a 3.7 metre wide bicycle lane cantilevered on the outside of the arch. There is a slight camber to the bridge deck, which causes water to run off toward the shoulder, rather than puddle on the bridge. No significant oil spills were observed, just the occasional drop of transmission oil, crankcase oil or hydraulic fluid. The asphalt pavement surface was worn, with some rutting evident. There were longitudinal cracks and lateral cracks although some portions had been planed and patched.

The application commenced on this portion of the bridge at 8:00 am. Ambient temperatures at the time of the application were in the 30 to 32 degree Celsius range, with humidity in the 75% range. Traffic was diverted to the two outside bicycle paths and the entire centre portion was treated with RJSeal™. Once this was dry, the vehicles were diverted onto the newly treated section and the outer bicycle paths were treated with RJSeal™. The application ceased at 6:30pm.

On September 4, the Desco D200 Sprayer was used to spray RJSeal on the northern end of the bridge deck. Here the width of the two driving lanes are 3.6 metres between the painted centre dividing line and the shoulder marker line. A bicycle path, nominally 2.5 metres, occurs on the outside of the driving lane. The work was completed in two stages, first on the east side (northbound lane) and once that was dry then the west side (southbound lane). Work on this most northerly portion finished at 6:00 pm. Photos showing the application of RJSeal™ follow in figures 4.3, 4.3 and 4.4 on the following pages.

The specific data for the application is shown in the table that follows:

Table 4.2			**Details of RJSeal™ Application**							
Work Schedule	Work Time (hrs)	Length (m)	Total Area m^2	Total Area yd^2	RJSeal™ Applied			Application Rate		
					US gals	litres	Kgs	US Gal /yd^2	m^2 /Litre	m^2/Kg
Sept 2, 04	5	233	3,029	3,620	181	683	740	0.050	4.44	4.27
Sept 3, 04	10.5	550	10,120	12,097	506	1,913	1,990	0.042	5.29	5.09
Sept 4, 04	11.5	1,028	13,364	15,975	865	3,269	3400	0.054	4.09	3.93
Totals	24	1,811	26,513	31,693	1,552	5,865	6,100	0.049	4.52	4.35

Figure 4.3 Slag Application,
Northbound Lane

Figure 4.4 Finished Surface,
Northbound Lane

4.1 RJSeal™ Testing

To date the comparison of the asphalt treated with RJSeal™ has been compared on a subjective basis over a very short period at the application site on Yangtze River Bridge. Testing equipment brought to the site for comparison on a more disciplined, objective basis consisted of an Outflow meter manufactured by Humble Equipment Co. of Reston, Louisiana, U.S.A. and a sand patch testing device purchased in China. These were to determine the Microtexture and Macrotexture of the asphalt pavement, which influence Water Dissipation (Hydroplaning Comparison).

Testing equipment will be brought to the site for comparison on a more disciplined, objective basis in the future, and to this end, the following tests will be undertaken.

- Hydroplaning Potential
- Water Penetration
- Macrotexture Depth
- Viscosity/Ductility Testing

. 4.2 Hydroplaning Potential

An "Outflow Meter" manufactured in the U.S.A. by Humble Equipment Company of Ruston, Louisiana and sold under the trademark "Outflow Meter" (see figure 4.3) was used to measure the asphalt pavement's macrotexture, as concern has been expressed about hydroplaning on the RJSeal™ treated surface, versus the untreated surface. The procedure is documented in the ASTM working paper, WK-364. The Outflow Meter gives readings in seconds for the dissipation of a known quantity of water. It is suggested that any readings between 3 and 10 seconds are satisfactory results for an asphalt pavement surface, if hydroplaning is to be minimized.

Readings were taken with this aforesaid Outflow Meter at locations on September 2 and 3 on that portion of the Bridge selected for the Application. The results are shown in the table that follows:

Table 4.3		**Outflow Meter Readings**		
Test Date	Location relative to curb of sidewalk on Bridge	Chainage Marks on Bridge	Before RJSeal™ (secs)	After RJSeal™ (secs)
Sept 2	3.3 m west	330 m north	24	n/a
Sept 3	5.9 m west	555 m north	96	n/a

- **Readings in the 3 to 10 second range are quite acceptable from a skid resistance/hydroplaning viewpoint.**

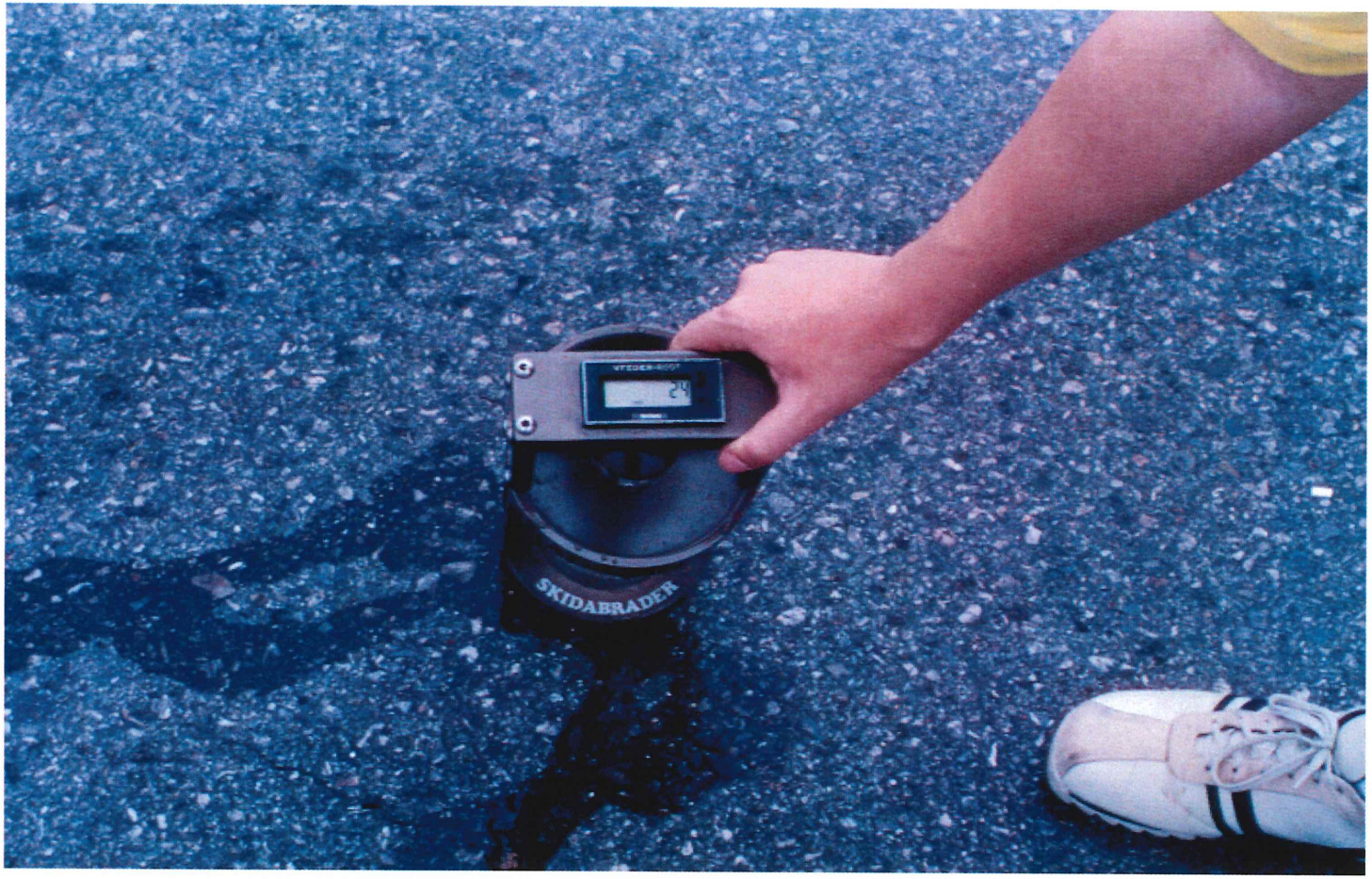

Figure 4.5
Humble Equipment Co. Outflow Meter

4.3 Water Penetration

Water Penetration Tests (China Testing Standard T 0730-2000) will be undertaken at several locations on the RJSeal™ treated section and the untreated portion of the road, in close proximity to the Outflow Meter Readings.

4.4 Macrotexture Depth

The sand patch test (ASTM Standard E965-96 OR China Standard T 0961-95) will be used to ascertain the Pavement Macrotexture Depth. Comparison was undertaken at several locations on both the untreated and RJSeal™ treated sections in close proximity to the Outflow meter tests.

Table 4.4		**Sand Patch Test Readings**		
Test Date	Location relative to curb of sidewalk on Bridge	Chainage Marks on Bridge	Before RJSeal™ Macrotexture Depth (mm)	After RJSeal™ Macrotexture Depth (mm)
Jan 25	1.3 m west	385 m west		n/a
Jan 25	2.6 m west	384 m west		n/a

4.5 Viscosity/Ductility Testing

This aspect of the testing is beyond the capabilities of the field equipment available to both Crown Capital Enterprise Limited and RJSeal™ personnel

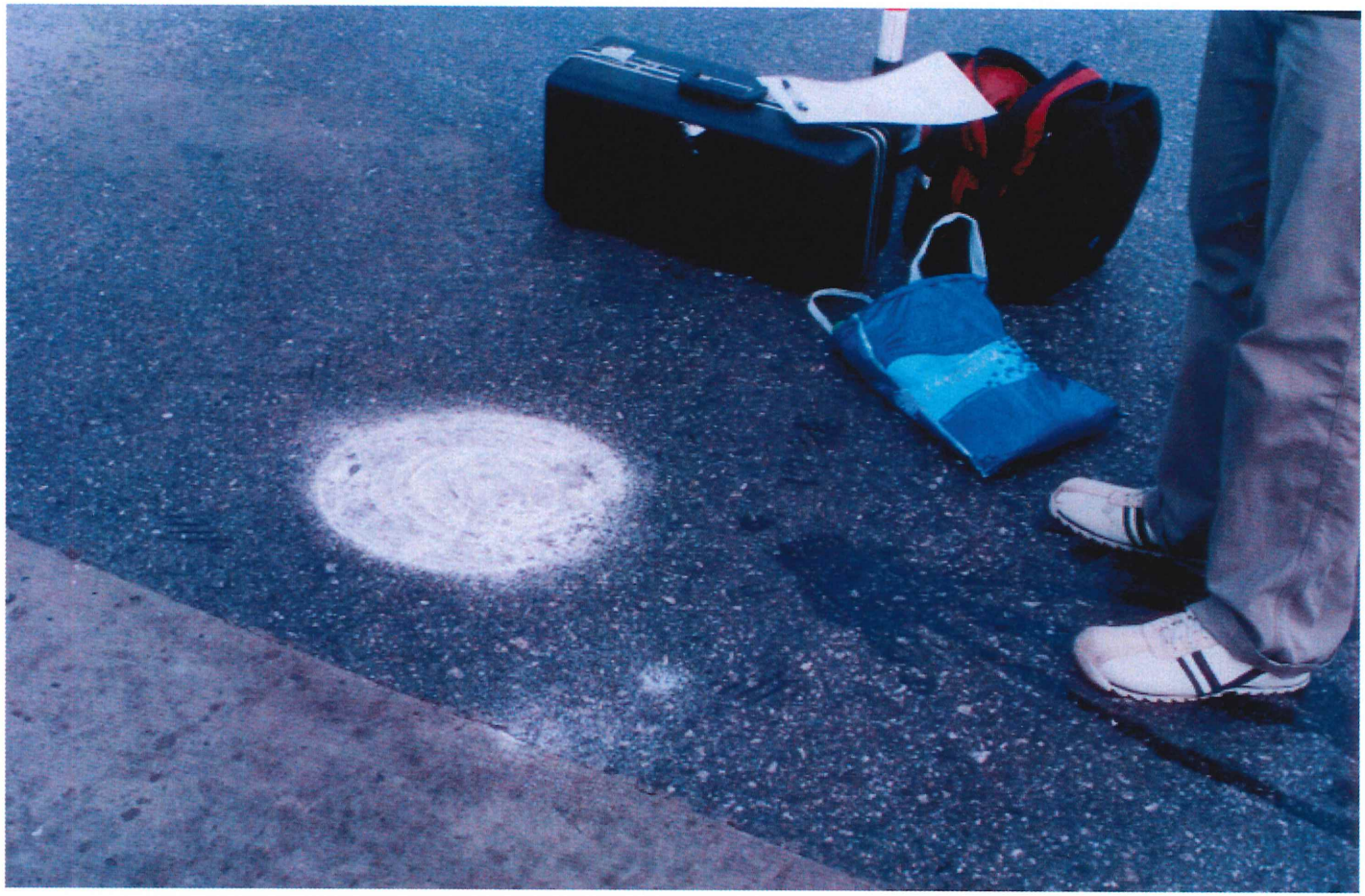

Figure 4.6 Sand Patch Test

5.0 Test Completion Schedule

The team of technicians from the Hong Kong office will be dispatched to undertake further testing on the trial section in the near future. The projected completion of this testing is scheduled as shown in the following chart.

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Appendix A

RJSeal™ – Descriptive Literature

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Appendix B

Technical Specifications
Desco D200 Sprayer

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Lamma, Hong Kong

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Appendix C

Size Analysis
Kunming Copper Slag

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